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## Article

# Towards Sustainable Waste Management through Cautious Design of Environmental Taxes: The Case of Ethiopia <sup>†</sup>

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**Abstract:** This research examines the viability of the design of environmental taxes in the achievement of sustainable waste management in the Addis Ababa Administration (AAA) of Ethiopia. It has employed an empirical qualitative method. It first shows the mutual contribution of the achievement of waste management to the progress of sustainable sanitation and water resource management. Secondly, it displays the distributive and incentive roles of environmental taxes in the achievement of sustainable waste management. Thirdly, it indicates that a cautious design of the source, base, scope and rate of environmental taxes is a critical determinant for environmental taxes' overall success in addressing the prevalent waste mismanagement in Ethiopia. Fourthly, it demonstrates that in the AAA: (1) The sources of solid waste collection, landfill, sewerage service and effluent charges are subject to the principle of legality; (2) the scope of solid waste collection, landfill, sewerage service and effluent charges is appropriate; (3) while the base of sewerage service and effluent charges is efficient, the base of solid waste and landfill charges is not at all efficient; and (4) while the rates of solid waste, landfill and sewerage service charges are slightly optimal, the rate of the effluent charge has not yet developed. Fifthly, it reveals that, having a somewhat viable design, solid waste, landfill and sewerage service charges are marginally reinforcing the aspiration of Ethiopia to achieve sustainable sanitation. Sixthly, it uncovers that because Ethiopia has not yet developed the rate of effluent charge, effluent charge is neither internalizing the cost of water resource degradation nor incentivizing sustainable water resource management. Finally, it implies that the aspiration of Ethiopia to achieve sustainable sanitation and water resource management by 2030 is contingent on the cautious design of its waste management taxes.

**Keywords:** SDGs; sustainable waste management; the PPP; environmental taxes

## 1. Introduction

### 1.1. Background of the Research

Sustainable waste management is one the goals of sustainable development (2030 Agenda for SD Goal 6) [1], and it is applicable both in developed and least developed countries (Agenda for SD at 2, 3, 11 and 12) [1].

The proper implementation of sustainable waste management mutually enhances the progress of sustainable sanitation and water resource management (AA AA TICFD at 5, 6) [2,3].

Sustainable waste management is defined as ‘using material resources efficiently to cut down on the amount of waste produced, and, where waste is generated, dealing with it in a way that actively contributes to sustainable development goals’ [4]. Accordingly, the waste management hierarchy that shall apply as a priority order in waste prevention and management legislation and policy consists of prevention, re-use, recycling, recovery and disposal (Directive 2008/98/EC Art 4) [4].

Price-based instruments were first suggested by Pigou in 1920 in the form of taxes and subsidies to deal with detrimental and beneficial environmental externalities [5–7]. Subsequently, different sources endorsed the use of environmental taxes to achieve sustainable waste management based on the polluter-pays principle (PPP) [4,8–11].

Concurrently, De Sadeleer verified that the variation of the distributive and incentive roles of environmental taxes is according to the redistributive or incentive function of the PPP (De Sadeleer, N. at 44, 46) [12].

In addition, cautious design of the source, base, scope and rate of environmental taxes is a critical determinant for their overall success in the full range of waste abatement options (see details in Section 6).

### 1.2. Statement of the Problem

Ethiopia is committed to sustainable development (see details in Section 3) and introducing incentives and disincentives to discourage practices that hamper the sustainable use of natural resources and the prevention of environmental degradation and pollution (DPDEOFDREA Art 4 (33) (1) (k); DPDEOFDRE; FEPOEP Art 6 (12)) [13–15]. Moreover, each of its urban administrations has the duty to ensure environmental tax-based sustainable waste management (Gebregiorgs, M. T. (2016) at 35–39) [11].

In addition, its law must provide a broad framework for both punitive and incentive measures, and where possible its tax structure has to be designed in a way that provides environmentally friendly positive incentives and negative incentives (EPE No. 5.2 (f); NCS II No. 3.6.2 (124) (g) (k); EWRMP No. 1 (1.3) (3), 2 (2.2.5) (B) (1) and (2); EWSS at 5) [16–19].

Ethiopia has given recognition to the PPP with its redistributive, preventive and incentive functions (Gebregiorgs, M. T. (2016) at 28–32) [11]. Moreover, earlier research by this author shows that the variation of the distributive and incentive roles of environmental taxes is according to the functions of the PPP (Gebregiorgs, M. T. (2016) at 14, 15, 19 and 20; De Sadeleer, N. at 46) [11,12]. In addition, it has demonstrated the instrumental roles of solid waste, landfill, sewerage service and effluent charges in the realization of sustainable waste management (Gebregiorgs, M. T. (2016) at 35–39) [11].

Nevertheless, at the moment, Ethiopia in general and Addis Ababa in particular exposed to water resources degradation associated with effluent [18,20–25], and to the mismanagement of solid waste (AACAASWP at 1; Bjerkli, C. L. 1277–1278) [26,27], sludge, and sewage [28–30]. Furthermore, the social cost of the waste management of public authorities in the Addis Ababa Administration (AAA) is mainly covered through public subsidy [31–34].

Different sources associate unsustainable waste management with the absence of a cautious design of the source, base, scope and rate of environmental taxes (see details in Section 6). Therefore, this research will assess the viability of the design of the source, base, scope and rate of environmental taxes in the achievement of sustainable waste management in the AAA of Ethiopia.

### 1.3. Research Questions

#### 1.3.1. Basic Research Question

How viable is the design of solid waste, landfill, sewerage service and effluent charges in the achievement of sustainable waste management in the AAA of Ethiopia?

### 1.3.2. Specific Research Questions

How viable is the design of the source, base, scope and rate of:

- a. Solid waste and landfill charges in the achievement of sustainable solid waste management,
- b. Sewerage service charges in the achievement of sustainable sewerage service, and
- c. Effluent charges in the achievement of the sustainable restoration of authorized water resources degradation in the AAA of Ethiopia?

## 2. Methodology

The research is delimited to the self-governing AAA, which is the capital city of Ethiopia and an integral part of the federal jurisdiction (FDREC Art 49 (1) (2) (3); AACGRCP Art 17 (1), 61 (2)) [35,36]. The research has employed an empirical qualitative method to assess the viability of the design of environmental taxes in the achievement of sustainable waste management in the AAA of Ethiopia. The qualitative analysis is iterative. Inferences are drawn through interpretation, and their validity is assured through primary and secondary data source triangulation. In this research, the design of the source, base, scope and rate of solid waste, landfill, sewerage service, and effluent charges is viable when the source is subject to the principle of legality, the scope is appropriate, the base is efficient, and the rate is optimal. The operationalization of the key words has been done in Section 7, through the development of a literature review-based normative framework in the context of sustainable waste management. Parallel to this, the research has used federal and AAA environmental and tax laws, official documents, key informant interviews, focus group discussions (FGD), and observation as the major sources of data on the law and practice of environmental tax-based waste management in the AAA of Ethiopia. Purposive sampling was used to select the key informants as well as the solid waste and effluent tax FGD participants, who are mainly from the Cleanliness Administration Agency; Solid Waste Re-use and Disposal Project Office; Water and Sewerage Authority; Environmental Protection Authority of the AAA; the Ministry of Water, Irrigation and Electricity; and the Ministry of Environment, Forest and Climate Change of Ethiopia. Finally, the legal and empirical data of the research is triangulated, interpreted and tested against the normative framework, and then concluding remarks and implications are presented.

### *Organization of the Article*

The article is organized into eight further sections. After this introduction, Section 3 deals with the idea of sustainable development. Section 4 looks at sustainable waste management. Section 5 considers the polluter-pays principle. Section 6 appraises the nature, source, role, base, scope and rate of environmental tax. Section 7 develops a normative framework for the use of environmental taxes to achieve sustainable waste management. Section 8 assesses the viability of the design of the source, base, scope, and rate of environmental taxes in the achievement of sustainable waste management in the AAA of Ethiopia. Finally, Section 9 presents the conclusion and implication of the research.

## 3. The Ideal of Sustainable Development

Sustainable development [37] provides the general framework for all environmental issues (Cullet, P. at 354) [38]. The ideal (goal) of sustainable development [39,40] renders a high moral value to environmental law principles, which are meant to implement the ideal of sustainable development (Verschuuren, J. (2006) at 1; Bell, S.; McGillivray, D. at 54) [40,41]. As such, they form a necessary link between legal rules and the ideal of sustainable development (Verschuuren, J. (2006) at 2, 52, 53; Bosselmann, K. at 48) [40,42].

Sustainable development goals (SDGs) are global in nature and universally applicable. They are integrated and indivisible (2030 Agenda for SD at 2, 3, 11, 12) [1], and the achievement of a particular SDG mutually contributes to the progress of other SDGs [2,3]. Accordingly, the proper implementation of waste management mutually enhances the progress of sustainable sanitation (2030 Agenda for SD at 12) [1] and water resource management (2030 Agenda for SD at 12) [1].

Correspondingly, Ethiopia has national [16–19,35,43–53] and international [1,8,9,35,54–58] commitment to the idea of sustainable development. In addition, it has embraced the 2030 Agenda for Sustainable Development, Agenda 2063 of Africa, and the Addis Ababa Action Agenda, and by 2030 it is aspiring to achieve sustainable sanitation and water resource management [1,52,53].

#### 4. Sustainable Waste Management

Sustainable waste management [4] is one of the goals of sustainable development (2030 Agenda for SD at 12) [1], and it is defined as ‘using material resources efficiently to cut down on the amount of waste produced, and, where waste is generated, dealing with it in a way that actively contributes to SDGs’ [4].

The various waste management options can be placed in an order known as the waste management hierarchy which reflects the relative sustainability of each [4]. Accordingly, the waste management hierarchy that shall apply as a priority order in waste prevention and management legislation and policy consists of prevention, re-use, recycling, recovery and disposal (Directive 2008/98/EC Art 4) [4].

In addition, different sources endorsed the use of environmental taxes to achieve sustainable waste management based on the PPP (Agenda 21 at 264, 2.14 (c), 4.24; Rio Declaration Principle 16; Snape, J.; de Souza, J. at 14; Gebregiorgis, M. T. (2016)) [8–11]. Correspondingly, the cautious design of the source, base, scope and rate of environmental taxes is a critical determinant for their overall success in the full range of waste abatement options (see details in Section 6).

#### 5. The Polluter-Pays Principle

The word environment is derived from the French word *environner*, which means to encircle (Shelton, D.; Kiss, A. at 4) [59], and it is a union of abiotic and biotic factors (Gilpin, A. at 92) [60] of renewable/non-renewable natural resources (Markandya, A. et al. at 79–80) [61].

Pollution/depletion, where private benefits and costs diverge from social benefits and costs (Pigou, A. C. at 172–203; Markandya, A. et al. at 94; Alm, J.; Banzhaf, H. S. at 178) [5,61,62], is one of the classic cases of negative externality (Pigou, A. C. at 21; De Sadeleer, N. at 21; Bell, S.; McGillivray, D. at 239; Markandya, A. et al. at 5, 94; OECD (2001) at 19) [5,12,41,61,63]. Concurrently, pollutant means any substance, whether liquid, solid or gas, that is intentionally/unintentionally released (FPCP Art 2 (15); AAEPCC Art 2 (14)) [45,64] and directly/indirectly adversely affects the quality of the environment (FPCP Art 2 (11); AAEPCC Art 2 (12)) [45,64].

The PPP is one of the main outlines of sustainable development (Snape, J.; de Souza, J. at 111) [10], and it is a framework where environmental protection and environmental taxation meet (Pitrone, F. at 130) [65]. Correspondingly, it has the following functions, as discussed in Sections 5.1 and 5.2.

##### 5.1. Redistributive Function of the PPP

One of the main functions of the PPP is an internalization of public authorities’ social costs for pollution prevention and control (De Sadeleer, N. at 35) [12] and the safeguarding of the public budget allocation for it (Pitrone, F. at 136) [65]. Hence, polluters should reimburse the state’s expenditures for pollution prevention and control (De Sadeleer, N. at 35; Shelton, D.; Kiss, A. at 4; Wolf, S.; Stanley, N. at 17; Kiss, A.; Shelton, D. at 95; Ashford, N. A.; Caldart, C. C. at 174) [12,59,66–68]. The redistributive function of the PPP thus envisages the internalization of the social costs borne by the public authorities for pollution prevention and control (De Sadeleer, N. at 311) [12].

From a scientific angle, degradation relates more to introducing pollutants into the ecosystem than to crossing a threshold of irreversibility. Setting an emission threshold necessarily leads to degradation that compromises the regenerative capacity of water, soil and air (De Sadeleer, N. at 37) [12]. Therefore, by stressing the curative dimension, the PPP should give rise to liability for residual damage that occurs due to authorized release and the inadequacy of established discharge thresholds (De Sadeleer, N. at 37) [12].

## 5.2. Incentive Function of the PPP

From the legal perspective, the PPP, with the objective of ensuring a coherent environmental policy, should be consistent with the principle of prevention. From an economic point of view, if the costs polluters must bear are greater than the benefits they anticipate from continuing their harmful behavior, they are encouraged to reduce pollution to the optimal level (De Sadeleer, N. at 36) [12].

Put at the service of prevention, the PPP means not allowing a polluter who pays to continue polluting with impunity. It therefore aims to encourage polluters to reduce their waste, and alter their waste generating behavior, rather than being content to pay taxes (Pearce, D. at 2) [69].

## 6. Nature, Source, Roles, Base, Scope and Rate of Environmental Tax

### 6.1. Nature of Environmental Tax

A levy is a tax if it is compulsory, legally enforceable, levied by a public body and intended for a public purpose, and it can be used to cover taxes, fees and charges (Snape, J.; de Souza, J. at 5; IBRD/WB at 33) [10,70].

On the basis of the European Union's Eurostat:

A tax falls into the category of environmental if the *tax base* is a *physical unit* (or a *proxy for it*) of something that has a proven specific negative impact on the environment, when used or released (European Commission at 9) [71].

The OECD, however, favors the terminology 'environmentally related tax' and defines it as 'any compulsory, unrequited payment to general government levied on tax-bases deemed to be of particular environmental relevance. Taxes are unrequited in the sense that benefits provided by government to tax payers are not normally in proportion to their payments (OECD (2001) at 15) [63].'

As a result, the name/stated purpose of a given fiscal instrument is not necessarily a universally applicable criterion for appraising the category of environmental tax (Joseph, S-A. at 188–190; IBRD/WB at 33) [7,70].

Correspondingly, on the basis of the definition of fiscal neutrality, a tax system should be designed so as primarily to raise revenue and not to encourage/discourage certain activities/behavior. Nevertheless, since fiscal neutrality is optimal only in the absence of externalities, changing the fiscal system in order to correct market failures is fully consistent with it. Therefore, even if environmental tax is not neutral, it is by default consistent with fiscal neutrality (Barde, J.-P. at 18) [72].

Correspondingly, in Ethiopia solid waste, landfill, sewerage service and effluent charges are indeed within the domain of the definition and nature of environmental tax set above [11].

### 6.2. Source of Environmental Tax

The modern principle of tax legality is a derivation from the great historical battles fought between legislative and executive bodies over the power of taxation (Taddese, L. at 335; Rodi, M.; Ashiabor, H. at 70) [73,74].

At the minimum, the principle of tax legality means that taxation must have a legal basis, and this is recognized as a constitutional precept in most legal systems (Vanistendael, F. at 2) [75].

Since environmental tax is part of a tax system, the legal authority enacting environmental taxes must consider the principle of legality in the context of rule of law (Rodi, M.; Ashiabor, H. at 59, 71, 74 [74]. Equally, the source of environmental taxes is subject to the principle of legality, and it has to be set up by legislative acts.

### 6.3. Instrumental Roles of Environmental Tax

The bases of environmental tax vary according to the redistributive or incentive function of the PPP (De Sadeleer, N. at 46) [12]. Correspondingly, this section is allocated to appraise the distributive and incentive roles of environmental taxes in the achievement of sustainable waste management.



### 6.3.1. Distributive Roles of Environmental Tax

Environmental fiscal reform opens the door to a new tax base, supplementing other revenue-raising efforts (IBRD/WB at 17) [70]. The underlying rationale of payment for ecosystem services is that beneficiaries of ecosystem services should compensate the stewards that maintain these services (Gomez-Baggethun, E.; Ruiz-Perez, M. at 7; UNEP at 26) [76,77]. As a result, when an environmental tax fulfills a redistributive function, the tax should be proportional to the pollution (De Sadeleer, N. at 46) [12] and the environmental risk created by commercialization (De Sadeleer, N. at 47) [12].

On the basis of the benefits received theory, the state provides various public goods and services to the society, and beneficiaries contribute in proportion to the benefits received (UNEP at 24; Bhatia, H. L. at 56) [77,78]. Accordingly, the distributive role assigned to environmental taxes argues in favor of the allocation of the revenue of environmental taxes for financing the environmental goal they target (De Sadeleer, N. at 47 and 48) [12].

Therefore, the distributive role of environmental tax is maintaining the ecosystem service and internalizing the social costs to the public authorities for pollution prevention and control (De Sadeleer, N. at 35, 47, 48; IBRD/WB at 20) [12,70]. *Mutatis mutandis*, one of the distributive roles of environmental taxes is internalizing the social cost of public authorities for waste collection, transportation, treatment and disposal.

### 6.3.2. Incentive Roles of Environmental Tax

An environmental tax is a fiscal instrument (Pitrone, F. at 127; Gaines, S. E.; Westin, R. A. at 10; Fasil, N. at 200) [65,79,80] that sends environmentally friendly signals to consumers and industrialists (Wolf, S.; Stanley, N. at 472) [66]. These taxes are the most emblematic instruments of the simultaneous intervention of the polluter-pays and prevention principles (De Sadeleer, N. at 47) [12].

Their incentive role encompasses a wide range of environmental taxes and encourages a more equal mix between cleaner production processes (De Sadeleer, N. at 47; Bell, S.; McGillivray, D. at 239; OECD (2001) at 20; IBRD/WB at 36; Kosonen, K. at 1) [12,41,63,70,81], innovation (Alm, J.; Banzhaf, H. S. at 179; Kolstad, C. D. at 151; Kosonen, K. at 1; Stewart, R. B. at 174) [62,82–84], end-of-pipe abatement measures (UNEP at 23; Stewart, R. B. at 175–176) [77,84], adoption of products that cause less pollution, development of less-polluting products and reduction of consumption (OECD (2011) at 4) [85]. *Mutatis mutandis*, one of the incentive roles of environmental taxes is encouraging the full range of waste abatement options.

### 6.4. Base of Environmental Tax

Environmental tax bases should be targeted to the pollutant (FPCP Art 2 (11); AAEPCC Art 2 (12)) [45,64] or the polluting behavior (OECD (2011) at 4) [84]. Using the tax to increase the market cost of the polluting activity helps to incentivize the full range of potential abatement options (OECD (2011) at 4) [85].

Alternatively, when taxing the pollutant directly is not administratively feasible, a close proxy for the polluting activity can provide a good tax base (OECD (2011) at 4) [85]. Nevertheless, it is important to note that levying the tax (OECD (2011) at 4) [85]:

- a. At higher levels of the supply chain would not treat the full range of solutions equally;
- b. On intermediate goods constitutes an implicit tax that may not be transparent and can contribute to misspecification of tax rates.

In parallel, tax reform should take care of statutory incidence, which refers to who legally pays the tax, as well as economic incidence, which refers to who really bears the burden of the tax (Kosonen, K. at 2) [82].

*Mutatis mutandis*, in waste management, the base of an environmental tax is efficient when it is targeted to the waste or waste-generating behavior, which helps to incentivize the full range of waste abatement options and can contribute to specification of an optimal tax rate.

### 6.5. Scope of Environmental Tax in a Federal System

A well-drafted tax law has to precisely spell out all the matters that are within its scope [74]. The scope of environmental tax is appropriate when it is as broad as the scope of the environmental damage being addressed (OECD (2011) at 5) [85].

The scope of environmental tax has implications for the level of political jurisdiction that imposes the tax (OECD (2011) at 5) [85]. Accordingly, if a fully functioning federal system (Vanistendael, F. at 49; Fasil, N. at 38) [75,80] offers some choice as to the level of government that should act to reduce environmental pollution, the first and most important principle is the geographic scope of the externality. If the effects of waste fall within the same jurisdiction as the source, then local governments are probably best situated to address the externality. However, if the waste has significant transboundary effects, then the national government is better positioned to address it (Alm, J.; Banzhaf, H. S. at 196, 197) [62]. The second principle is that the instrument should be consistent with the fiscal needs of the level of government (Alm, J.; Banzhaf, H. S. at 187, 197) [62].

Mutatis mutandis, the scope of environmental tax in a federal system is appropriate when it is as broad as the scope of the waste being addressed, and it is consistent with the fiscal needs of the federal and regional waste management organs.

### 6.6. Rate of Environmental Tax

According to Pigou, the optimal tax rate is where the marginal benefit of abatement equals the marginal cost of abatement [5]. Increasing and lowering of tax rates is one of the instruments for manipulating the fiscal policy of a government (Fasil, N. at 200) [80].

Since environmental taxes are part of the environmental policy instrument tool box, their tax rates should be in line with environmental policy objectives (Rodi, M.; Ashiabor, H. at 70) [74]. Equally, to reach an environmental objective, it is important that the rate of an environmental tax is set at a correct level. A levy that is too low will not be able to fully correct a distortion in the market, while a levy that is too high replaces one distortion with another (Commission of the European Communities at 1) [86].

Mutatis mutandis, the rate of environmental tax is optimal when it is commensurate with the cost of waste management, and it creates an incentive for the realization of sustainable waste management (Directive 2008/98/EC Preamble No. 25, Art 14 (1); De Sadeleer, N. at 46 and 47; OECD (2011) at 1) [4,12,85].

## 7. Interim Conclusion: Normative Framework for the Use of Environmental Taxes to Achieve Sustainable Waste Management

Sustainable waste management is one the goals of sustainable development (2030 Agenda for SD at 12) [1], and it is defined as ‘using material resources efficiently to cut down on the amount of waste produced, and, where waste is generated, dealing with it in a way that actively contributes to SDGs’ [4]. Accordingly, the waste management hierarchy that shall apply as a priority order in waste prevention and management legislation and policy consists of prevention, re-use, recycling, recovery and disposal (Directive 2008/98/EC Art 4) [4].

Different sources have endorsed the use of environmental taxes to achieve sustainable waste management based on the PPP (Agenda 21 at 264, 2.14 (c) and 4.24; Rio Declaration Principle 16; Snape, J.; de Souza, J. at 14; Gebregiorgis, M. T. (2016)) [8–11]. Concomitantly, cautious design of the source, base, scope and rate of environmental taxes is a critical determinant for their overall success in the full range of waste abatement options (see details in Section 6). Correspondingly, the following are the interim conclusions of this research:

1. The distributive and incentive roles of environmental taxes vary according to the redistributive or incentive function of the PPP (for details, see Sections 5 and 6.3),
2. SDGs are integrated and indivisible, and the achievement of one SDG mutually contributes to the progress of others (for details, see Sections 3 and 4),



3. The proper implementation of waste prevention, re-use, recycling, recovery and disposal mutually contributes to the progress of sustainable sanitation and water resource management (for details, see Section 4),
4. To avoid taxation without representation, the source of environmental taxes must be subject to the principle of legality in the context of rule of law (for details, see Section 6.2),
5. The scope of environmental tax in a federal system is appropriate when it is as broad as the scope of the waste being addressed and it is consistent with the fiscal needs of the federal and regional waste management organs (for details, see Section 6.5),
6. The base of environmental tax is efficient when it is targeted to the waste or waste generating behavior and it helps to incentivize the full range of waste abatement options and can contribute to specification of an optimal tax rate (for details, see Section 6.4), and
7. The rate of environmental tax is optimal when it is commensurate with the cost of waste management and it creates an incentive for the realization of sustainable waste management (for details, see Section 6.6).

Ethiopia is committed to a federal system, sustainable waste management, the PPP and the distributive and incentive roles of environmental taxes in the achievement of sustainable waste management. Correspondingly, in this research, the design of solid waste, landfill, sewerage service and effluent charges is considered to be viable in the achievement of sustainable waste management when the source is subject to the principle of legality, the scope is appropriate, the base is efficient, and the rate is optimal.

## 8. The Viability of the Design of Environmental Taxes in the Achievement of Sustainable Waste Management in the AAA of Ethiopia

### 8.1. Constitutional and International Law Bases of Environmental Taxes in Ethiopia

#### 8.1.1. Constitutional Law

Environmental tax law is subject to the constitutional precondition of a given nation and in some cases to the relevant international laws (Rodi, M.; Ashiabor, H. at 59) [74].

The federal constitution of Ethiopia is the supreme law of the land (FDREC Art 9 (1)) [35], and the fundamental authority to tax is derived from it (Taddese, L. at 330) [73]. Even though the constitution does not explicitly require taxation to have a firm basis in law, it can be inferred from its provisions that it grants the federal and regional legislative organs the power to impose taxes on their respective sources (FDREC Art 51, 52, 55; Taddese, L. at 337) [35,73].

On the basis of its directives on taxation (FDREC Art 100) [35]:

1. In exercising their taxing powers, States and the Federal Government shall ensure that any tax is related to the source of revenue taxed and that it is determined following proper considerations.
2. They shall ensure that the tax does not adversely affect their relationship and that the rate and amount of taxes shall be commensurate with services the taxes help deliver.

In addition, the scope of the constitution regarding tax is broadly designed in a way that it encompasses both federal and states' benefit and non-benefit taxes, which are the bases of a range of environmental taxes (FDREC Art 96, 97 and 98; AACGRCP Art 52, 53, 61) [35,36].

#### 8.1.2. International Law

'The authority of the state to legislate in tax matters may be limited by international treaties and agreements' (Vanistendael, F. at 16) [75]. Equally, the authority to legislate environmental taxes must safeguard the framework of public international law (Rodi, M.; Ashiabor, H. at 79) [74], and one of the prerequisites to its application is conformity with international law (Barde, J.-P. at 23, 28) [72].

In Ethiopia, all international agreements established by the federal government shall protect and ensure Ethiopia's right to sustainable development (FDREC (n19) Art 43 (3)) [35]. Concurrently, all international agreements ratified by the federal government are an integral part of the law of the land, and they are part of the constitutional interpretation clauses (FDREC Art 9 (4), 13 (2), 43 (3), 51 (8), 55 (12)) [35].

Ethiopia is committed to developing a national environmental liability and compensation regime (Rio Declaration Principle 7, 11, 13) [9]. In addition, since Ethiopia has an international commitment to the use of environmental taxes to achieve sustainable waste management, it can use environmental tax to revitalize its global partnership for sustainable development (2030 Agenda for SD Goal 6; Agenda 21 at 2.14 (c), 4.24; Rio Declaration Principle 16) [1,8,9].

### 8.1.3. International Trade

The federal government of Ethiopia has the duty to enact specific laws that regulate foreign trade and forge and promote mutual interest-based economic union and relations (FDREC Art 51 (4) (8) (12), 55 (2) (b), 86) [35].

To that effect, it has applied to the World Trade Organization (WTO), and its application was received on 13 January 2003 [87]. In line with the Most-Favoured-Nation Treatment Principle [88] and the Chapeau of Article XX [88], General Agreement on Tariffs and Trade (GATT) recognizes the adoption/enforcement by any contracting party of measures necessary to protect human, animal/plant life/health and to conserve exhaustible natural resources (GATT Art XX (b) and (g)) [88].

Thus, the use of environmental taxes to achieve sustainable waste management is congruent with Ethiopia's foreign trade policy and its endeavor to accede to the WTO.

### 8.2. Source of Solid Waste Management, Sewerage Service and Effluent Charges

To avoid taxation without representation, the legal authority enacting environmental taxes must take a variety of material restrictions into account, including constitutional principles such as the principle of legality in the context of rule of law (Rodi, M.; Ashiabor, H. at 59) [74].

Accordingly, Ethiopia is strongly committed to building a political community based on the rule of law, and its states have the duty to do their best to advance the rule of law (FDREC Preamble and Art 52 (2) (a)) [35]. Moreover, in Ethiopia in general and Addis Ababa in particular, it is established that no public money shall be collected except when authorized by law (AACGRCP Art 52, 58 (1); FGEFAP Art 10 (1); AAFAP Art 10 (1)) [36,89,90].

In addition, since Ethiopia is part of the civil law legal system (Tesfaye, A. at 32, 58) [91], its substantive and procedural laws pertaining to taxation flow from tax proclamations, regulations and directives (Taddese, L. at 356) [73]. Accordingly, its federal and AAA laws have to be published in the Federal Negarit Gazeta (FNGEP Art 2 (1) and 2 (2); HPRERPMCCR Art 58) [92,93] and Addis Negarit Gazeta, respectively; and all persons shall take judicial notice of them (AACGRCP Preamble, Art 61 (7); Fasil, N. at 86; FNGEP Art 2 (3); AAFAR Art 24) [36,82,92,94].

Furthermore, in Ethiopia interpretation of a law by the Federal Supreme Court rendered by the cassation division with not less than five judges shall be binding on federal as well as regional courts at all levels (FCPRAP Art 2 (1); FCP Art 10) [95,96]. Concomitantly, a recent ruling by the Cassation Division of the Federal Supreme Court has indicated that to have a legally binding effect, directives do not have to be published in the Negarit Gazeta, or to be displayed in a specified language [97]. Additionally, in service delivery-based charges, the provisions of a contract lawfully formed between two or more persons shall be binding on the parties as though they were law (CCEEP Art 1675 and 1731 (1)) [98].

Subsequently, in Ethiopia, when environmental tax is incorporated in any of the foregoing sources of law, it is authorized by law and all persons shall take judicial notice of it.

Accordingly, the solid waste management [99,100], sewerage services [101–103] and federal effluent [104,105] charges in the AAA are set up by legislative acts, and everyone is bound to take

judicial notice of them. Thus, their sources are subject to the principle of legality in the context of rule of law and, in turn, there is no ground for environmental taxation without representation.

### 8.3. *Scope of Solid Waste Management, Sewerage Service and Effluent Charges*

The scope of environmental tax in a federal system is appropriate when it is as broad as the scope of the waste being addressed and it is consistent with the fiscal needs of the federal and regional waste management organs (see details in Section 6.5). In parallel, this section will assess how appropriate the scope of solid waste management, sewerage service and effluent charges is in the AAA of the Federal Democratic Republic of Ethiopia.

#### 8.3.1. Environmental and Fiscal Federalism in Ethiopia

The term ‘federal’ comes from the Latin word *foedus*, meaning ‘treaty.’ A federation is a dual polity where the distribution of power between the federal and state governments is strictly constitutional (Fasil, N. at 36) [80], and fiscal federalism is a process of redistribution of fiscal decision-making power across multi-leveled governments in an effort to achieve sustainable development (Abu, G. at 1; De Mello, L. R., J. R. at 365) [106,107].

‘The Federal Democratic Republic of Ethiopia comprises the federal government and the state members’ (FDREC Art 1, 50 (1)) [35]. The federal government of Ethiopia has the mandate to enact specific laws on the utilization and conservation of land and other natural resources, as well as of rivers and lakes crossing the boundaries of the national territorial jurisdiction or linking two/more states (FDREC Art 55 (2) (a)) [35]. Moreover, it shall determine and administer the utilization of the waters/rivers and lakes linking two/more states or crossing its territorial boundaries (FDREC Art 51 (11)) [35]. Simultaneously, all residual powers not expressly given to the federal or concurrent jurisdictions are reserved to the states (FDREC Art 52 (1)) [35]. Additionally, states have the power ‘to administer land and other natural resources in accordance with federal laws (Gebregiorgis, M. T. (2016) at 26; FEPOEP Art 15 (2); FDREC Art 52 (2) (d); FPCP Art 6 (4); Alm, J.; Banzhaf, H. S. at 194; Oates, W. E. at 1) [11,15,45,62,107,108].’

Furthermore, in Ethiopia there are federal, state, concurrent and undesignated powers of taxation (FDREC Art 96–99) [35]. Concurrently, the federal government and the states shall share revenue, taking the federal arrangement into account, and they shall respectively bear all financial expenditures necessary to carry out all responsibilities and functions assigned to them by law (FDREC Art 94 (1), 95) [35]. Therefore, the fiscal federalism of Ethiopia has room for the introduction of federal and state revenue-providing instruments that are consistent with their fiscal needs.

#### 8.3.2. Scope of Solid Waste Management and Sewerage Service Charges

In a federal system, if the effects of waste fall within the same jurisdiction as the source, then local governments are probably best situated to address the externality through the institution of an environmental tax-based waste management system (Alm, J.; Banzhaf, H. S. at 196–197) [62].

In Ethiopia all urban administrations are bound to ensure sustainable municipal waste collection, transportation, recycling, treatment and safe disposal through the institution of an environmental tax-based waste management system [11].

Accordingly, the Addis Ababa Cleanliness Administration Agency (AACAA) [99,100,109], the Addis Ababa Solid Waste Re-use and Disposal Project Office (AASWRDPO) [99,109], and the Addis Ababa Water and Sewerage Authority (AAWSA) [99,101–103,109] are respectively bound to ensure environmental tax-based sustainable solid waste collection, landfill, and sewerage services in the AAA (AAWMCDR Art 25) [99].

The scope of the solid waste, landfill and sewerage service charges of the AAA is as broad as the scope of the municipal waste damage being addressed and the fiscal needs of the AACAA, AASWRDPO and AAWSA respectively. Therefore, it is safe to conclude that the scope of the solid waste management and sewerage service charges of the AAA is appropriate.

### 8.3.3. Scope of Effluent Charge

In a federal system, if the waste has significant transboundary effects, then the national government is better positioned to address the externality through the institution of an environmental tax-based waste management system (Alm, J.; Banzhaf, H. S. at 196–197) [62].

Accordingly, in Ethiopia, the federal government has the mandate to administer rivers linking two or more states or crossing the territorial jurisdiction of Ethiopia (FDREC Art 51 (11)) [35]. Concurrently, the Ministry of Water, Irrigation and Electricity of Ethiopia (MWIEE) is bound to address the externality through the practical implementation of an effluent charge (EFWRMP Art 20 (1) (c), 22) [104].

The scope of the federal effluent charge of Ethiopia is as broad as the scope of the degradation of the water resources being addressed and the fiscal needs of the MWIEE. Thus, it is safe to conclude that the scope of the federal effluent charge of Ethiopia is appropriate.

## 8.4. Base of Solid Waste Management, Sewerage Service and Effluent Charges

The base of an environmental tax is efficient when it is targeted to the waste or waste generating behavior, which helps to incentivize the full range of waste abatement options and can contribute to specifying an optimal tax rate (see details in Section 6.4). Concurrently, this section will appraise the efficiency of the base of solid waste management, sewerage service and effluent charges in the AAA.

### 8.4.1. Base of Solid Waste Management Charges

In the AAA, the Addis Ababa Cleanliness Administration Agency (AACAA) and the Addis Ababa Solid Waste Re-use and Disposal Project Office (AASWRDPO) are bound to ensure environmental tax-based sustainable solid waste management (RDCSSTAACG Art 5 (1)) [100].

On the basis of the Solid Waste Management Proclamation of Ethiopia, ‘solid waste is anything that is neither liquid nor gas and is discarded as unwanted (AAWMCDR Art 2 (3); RDCSSTAACG Art 2 (9); SWMP Art 2 (6)) [99,100,110].’ Correspondingly, the base of solid waste and landfill charges is efficient when it is targeted to the solid waste (see details in Section 6.4).

In practice, water consumption is taken as the base of solid waste and landfill charges (RDCSSTAACG Art 5 (1)) [100]. Since targeting water consumption as the base of the charges does not increase the market cost of the polluting activity, it does not incentivize a full range of solid waste abatement options (OECD (2011) at 4) [85]. Additionally, it does not help to specify an optimal rate for solid waste and landfill charges that is commensurate with the AACAA and AASWRDPO solid waste collection and landfill services respectively.

As a corollary, taking water consumption as the base of solid waste and landfill charges of the AAA is not at all efficient.

### 8.4.2. Base of Sewerage Service Charges

#### Base of Sludge Dislodging Service Charge

At the moment, Addis Ababa Water and Sewerage Authority (AAWSA) is bound to provide a sludge dislodging service through the implementation of a sludge dislodging charge (AAWSSDSRRR Art 6 (1) and (2), Schedule III, No. 1 and 2) [102].

On the basis of the AAWSA Re-establishment Proclamation, ‘sludge is the content of any waste water settled in waste water facilities (AAWSARP Art 2 (22)) [101],’ and it is targeted as the base of the sludge dislodging charge (AAWSSDSRRR Art 6 (1) and (2), Schedule III, No. 1 and 2) [102].

Targeting the volume of the sludge, the pollutant, as the base of the charge increases the market cost of the polluting activity, which helps to incentivize the full range of sludge abatement options. In addition, it helps to specify an optimal sludge dislodging charge rate that is commensurate with AAWSA and with private sludge dislodging services.

Thus, it is safe to conclude that taking sludge as the base of the sludge dislodging charge of the AAA is efficient.

### Base of Sewer Service Charge

At the moment in the AAA, there is 10% sewer service coverage [111–116] and the Addis Ababa Water and Sewerage Authority (AAWSA) is bound to deliver sewer service through the implementation of a sewer service charge (AAWSSDSRRR Schedule I) [101].

In sewerage management, the base of the sewer service charge is efficient when it is targeted to sewage (AAWSARP Art 2 (23)) [101], the pollutant, or to its close proxy. In practice, water consumption in cubic meters, which is a close proxy of sewage, is targeted as the base of the sewer service charge of the AAA (AAWSSDSRRR Schedule I) [102].

Targeting water consumption in cubic meters as the base of the charge increases the market cost of the polluting activity, which by and large helps to incentivize a full range of sewage abatement options. In addition, it helps to specify an optimal sewer service charge rate that is commensurate with AAWSA sewer service.

Therefore, it is safe to conclude that taking water consumption in cubic meters as the base of the sewer service charge of the AAA is by and large efficient.

### 8.4.3. Base of Effluent Charge

In Ethiopia, the Ministry of Water, Irrigation and Electricity (MWIEE) may issue permits for the release of treated waste into rivers linking two or more states or crossing the territorial jurisdiction of Ethiopia and may collect effluent charges from permit holders (EFWRMP Art 11 (1) (d), 13 (2), 20 (1) (c), 22; EWRMR Art 5, 11, 12, 13, 14, 32) [104,105].

On the basis of the Ethiopian Water Resources Management Proclamation, ‘waste means any harmful matter introduced, released or discharged into any water body in any solid, liquid or gaseous form (EFWRMP Art 2 (10)) [104],’ and it is targeted as the base of the effluent charge (EWRMR Art 12 (1) (b)) [105].

Targeting the type and volume of waste as the base of the effluent charge helps to incentivize the full range of effluent abatement options (OECD (2011) at 4) [85]. In addition, it helps to specify an optimal effluent charge rate that is commensurate with MWIEE restoration of authorized degradation of rivers linking two or more states or crossing the territorial jurisdiction of Ethiopia.

Therefore, it is safe to conclude that taking the type and volume of treated waste as the base of the federal effluent charge of Ethiopia is efficient.

### 8.5. Rate of Solid Waste Management, Sewerage Service and Effluent Charges

An unregulated market has room for unabated externalities (Pigou, A. C. at 134; Alm, J.; Banzhaf, H. S. at 179; Ashford, N. A.; Caldart, C. C. at 132; Stewart, R. B. at 172) [5,62,68,84], and grants an implicit subsidy to polluters (Murty, M. N. at 130; Snape, J.; de Souza, J. at 119) [6,10]. Therefore, when a market fails (Markandya, A. et al. at 129; Bhatia, H. L. at 5) [61,78] to appreciate the opportunity costs of environmental use, it causes overuse of the environment and overproduction of ecologically harmful products (Siebert, H. at 17,18) [117].

Meanwhile, environmental tax provides an ideal means of injecting appropriate price signals and creating markets for unpriced resources and environmental services (Pigou, A. C. at 172; Murty, M. N. at 128; Bell, S.; McGillivray, D. at 239; Barde, J-P. at 10; UNEP at 29) [5,6,41,72,77], and its revenue achieves its distributive role when it is used for financing the environmental goal it targets (De Sadeleer, N. at 47, 48) [12].

In addition, the rate of environmental tax is optimal when it is commensurate with the cost of waste management, and it creates an incentive for the realization of sustainable waste management (UNEP at 23; Stewart, R. B. at 175–176) [77,84]. Correspondingly, this section will assess whether the rates of the solid waste management, sewerage service and effluent charges in the AAA are optimal or not.



### 8.5.1. Rate of Solid Waste Management Charges

On the basis of the Solid Waste Management Proclamation of Ethiopia, ‘solid waste management means the collection, transportation, storage, recycling or disposal of solid waste, or the subsequent use of a disposal site that is no longer operational (SWMP Art 2 (7)) [110].’ Concurrently, this section is allocated to appraise how optimal the rates of solid waste and landfill charges are in the realization of sustainable solid waste management.

#### Rate of Solid Waste Collection Service Charge

In the AAA, the Addis Ababa Cleanliness Administration Agency is bound to internalize the social cost of its solid waste collection service and to incentivize sustainable solid waste management through the implementation of a solid waste charge (Gebregiorgs, M. T. (2016) at 35–37; FPCP Art 5 (1); AAWMCDD Art 25 (1) and (2); RDCSSTAACG preamble, Art 3, 5, 6; AAEMSOP Art 53 (6), 55) [11,45,98,99,109,118–123].

Accordingly, on the basis of Regulation 25/2009, the revenue of the solid waste charge shall be used for implementing the following activities (RDCSSTAACG Art 6) [100]:

1. For payment of the sanitary service activity in the city that is ordered by the agency according to its contractual service;
2. To purchase sanitary vehicles, machinery and other items that are necessary for the sanitary service of the city;
3. To fulfill different suitable modern technologies that help to improve the sanitation of the city;
4. To reward and encourage the workers and institutions that make great contributions to the sanitary service of the city; and
5. To undertake research, counseling activities and other related works that could help the sanitation service of the city.

In practice, AACAA is collecting a solid waste charge from households and organizations with their monthly water bill, which is computed on the basis of the following schedule (RDCSSTAACG Art 5 (1), Annex 1; AACAA AR 2015 at 29; AACAA AR 2016 at 14; AACAA AR 2017 at 4, 20) [100,124–126], as show in Table 1.

**Table 1.** Sanitary Service Tariff that is collected with the Water Bill.

No.	Name of the Customer	The Tariff Rate of Water Sewerage (m <sup>3</sup> )	The Previous Tariff Rate of Sanitary Service (%)	The Revised Tariff Rate of Sanitary Service (%)
1	The common public water service	1.75	0	5
2	[Household customers]			
	➤ From 0–7 m <sup>3</sup>	1.75	5	20
	➤ From 7–20 m <sup>3</sup>	3.15	5	20
	➤ From 20 m <sup>3</sup>	3.80	5	20
3	Customers other than household customers	3.80	0	42.5

However, since the rate of the solid waste charge is so nominal [119–123], and there is only a partly effective solid waste charge collection system (Gebregiorgs, M. T. (2018) at 346–352) [119–123,127], AACAA is slightly translating the distributive role of the solid waste charge into action (AACAA AR 2015; AACAA AR 2016 at 14; AACAA AR 2017 at 4, 20 and 36) [119–126].

As a result, the lion’s share of the social cost of its solid waste collection service (AACAA AR 2015 at 4, 25; AACAA AR 2016 at 3, 11; AACAA AR 2017 at 3, 19) [124–126] is covered by the subsidy it is allocated from AAA (AACG 2006 E.C. FY BP at Table 2 No. 523; AACG 2007 E.C. FY BP at Table 2 No. 523; AACG 2008 E.C. FY BP at Table 2 No. 523; AACG 2009 E.C. FY BP at Table 2 No. 523) [31–34,119–123].



### Rate of Landfill Charge

The landfill charge is a levy on the landfilling of waste, and its goals are to internalize the environmental costs of landfill; to give better price signals for alternatives to landfill; and to assist in meeting waste targets in the most efficient way (Snape, J.; de Souza, J. at 4, 115 and 214) [10].

In the AAA, the Addis Ababa Solid Waste Re-use and Disposal Project Office (AASWRDPO) is bound to internalize the social cost of its landfill service and to incentivize sustainable solid waste management through the practical implementation of a landfill charge (Gebregiorgs, M. T. (2016) at 35–37; FPCP Art 5 (1); AAWMCDR Art 25 (1) and (2); RDCSSTAACG Art 5 (3) (b); AAEMSOP Art 53 (6), 58) [11,45,99,100,109,123,128,129].

In practice, AASWRDPO is collecting 4 ETB (USD 0.15)/1 m<sup>3</sup> landfill charge in tandem with the solid waste charge of the AACAA (AASWRDPO AR 2015; AASWRDPO AR 2016 at 16; AASWRDPO AR 2017) at 4, 17) [130–132].

Nevertheless, since the rate of the landfill charge is so nominal [123,128,129] and there is only a partly effective landfill charge collection system (Gebregiorgs, M. T. (2018) at 353–355) [119–123,127], AASWRDPO is slightly translating the distributive role of the landfill charge into action [123,128,129]. Consequently, the lion's share of the social cost of its landfill service (AASWRDPO AR 2015, AASWRDPO AR 2016 at 9; AASWRDPO AR 2017 at 4, 15) [130–132] is covered by the subsidy it is allocated from AAA (AACG 2006 E.C. FY BP Table 2 No. 524; AACG 2007 E.C. FY BP Table 2 No. 524; AACG 2008 E.C. FY BP at Table 2 No. 524; AACG 2009 E.C. FY BP at Table 2 No. 524) [31–34,123,128,129].

Simultaneously, since the rates of the solid waste and landfill charges are nominal, they are not creating an incentive for the residents of the AAA to sustainably manage their solid waste. (Bjerkli, C. L. at 1277, 1278) [27,119,120,123,128,129,133].

Therefore, it is safe to conclude that at the moment, the solid waste and landfill charges of the AAA are slightly optimal and they are marginally reinforcing the aspiration of Ethiopia to achieve sanitation for all by 2030.

### 8.5.2. Rate of Sewerage Service Charges

On the basis of the Addis Ababa Water and Sewerage Authority (AAWSA) Re-establishment Proclamation, 'sewerage service shall mean the collection, treatment and disposal of waste water/sewage' (AAWSARP Art 2 (21)) [101].

In the AAA, the AAWSA is bound to internalize the social cost of its sewerage service, and to incentivize sustainable sewerage management through the practical implementation of sewerage service charges: Sludge dislodging and sewer service charges (Gebregiorgs, M. T. (2016) at 38, 39; FPCP Art 5 (1); AAWMCDR Art 25 (1) and (2); AAWSARP Art 5 (2), 7 (1); 14 (2) and 25; AAWSSDSRRR Preamble, Art 6, 39 and Schedule I and III; AAEMSOP Art 53 (6) and 59) [11,45,98,101,102,109,111,114,134,135]. Concurrently, this section is allocated to appraise how optimal the rates of sludge dislodging, and sewer service charges are in the realization of sustainable sewerage service.

### Rate of Sludge Dislodging Charge

The AAWSA has a special mandate that allows it to collect a sludge dislodging charge for its vacuum trucks-based sludge dislodging service (AAWSARP Art 16 (2) (a); AAWSSDSRRR Art 39 (1)) [101,102].

Accordingly, it is collecting a 176 ETB (USD 6.46) sludge dislodging charge per trip from its household customers [111,134–138].

Nevertheless, since the rate of the sludge dislodging charge is so nominal [111,114,134–138], AAWSA is slightly translating the distributive role of its sludge dislodging charge [111,114,134–138].

### Rate of Sewer Service Charge

At the moment, in the AAA there is 10% sewer service coverage and the Addis Ababa Water and Sewerage Authority (AAWSA) is bound to deliver sewer service through the implementation

of a sewer service charge (AAWSSDSRRR Schedule I) [102]. Accordingly, in 2010, on the basis of Regulation No. 31/2002, the AAWSA was collecting sewer service charges on the basis of the rates indicated in the following tables (AAWSSDSRRR Art 5, Schedule I) [102].

**Table 2.** Five Years Tariff for Sewerage Disposal Service of AAWSA.

Block		First Year Tariff 8 July 2002 to 7 July 2003	Second Year Tariff 8 July 2003 to 7 July 2004	Third Year Tariff 8 July 2004 to 7 July 2005	Fourth Year Tariff 8 July 2005 to 7 July 2006	Fifth Year Tariff 8 July 2006 to 7 July 2007
		Tariff/m <sup>3</sup> (in Birr)	Tariff/m <sup>3</sup> (in Birr)	Tariff/m <sup>3</sup> (in Birr)	Tariff/m <sup>3</sup> (in Birr)	Tariff/m <sup>3</sup> (in Birr)
Public Fountain		Sewerage	Sewerage	Sewerage	Sewerage	Sewerage
		-	-	-	-	-
Domestic Customers (Monthly Water Consumption in Cubic Meters)	0–7	-	-	-	-	-
	Above 7 up to 20	0.35	0.40	0.45	0.50	0.55
	Above 20	0.35	0.40	0.45	0.50	0.55
Non-domestic Consumers		0.35	0.40	0.45	0.50	0.55

Later on, in 2011, with the objective to enhance the internalization of the cost of its water supply and sewerage disposal service, AAA amended Schedule I of Regulation No. 31/2002 without explicitly indicating the rate of the sewer service charge (AAWSSDSRA Preamble) [103].

For that reason, at the moment, it is hardly possible to clearly see whether the rate of the sewer service charge is optimal or not and to trace the specific destination of the revenue it generates.

As a logical extension of the foregoing points, the lion's share of the social cost of the sewer (AAWSA WWTRSP 2015 AR at 1; AAWSA WWTRSP 2016 AR at 101; AAWSA WWTRSP 2017 AR at 72) [28–30], sludge dislodging (AAWSA WWTRSP 2015 AR at 1, 2; AAWSA WWTRSP 2016 AR at 102; AAWSA WWTRSP 2017 AR at 72) [28–30], and waste water treatment and disposal (AAWSA WWTRSP 2015 AR at 1, 2; AAWSA WWTRSP 2016 AR at 101, 102; AAWSA WWTRSP 2017 AR at 72, 73) [28–30] services of the AAWSA is covered by the subsidy it is allocated from AAA (AACG 2006 E.C. FY BP Table 2 No. 221; AACG 2007 E.C. FY BP Table 2 No. 221; AACG 2008 E.C. FY BP at Table 2 No. 221; AACG 2009 E.C. FY BP (n18) at Table 2 No. 221) [31–34,111,114,134–138].

In addition, because the rate of the sewerage service charges is nominal, it is not creating an incentive for the residents of the AAA to sustainably manage their sludge and sewage [111,114,134–140].

Therefore, it is safe to conclude that, at the moment, the sewerage service charge of the AAA is slightly optimal and is marginally reinforcing the aspiration of Ethiopia to achieve sanitation for all by 2030.

### 8.5.3. Rate of Effluent Charge

In Ethiopia, all water resources are the common property of the Ethiopian people and the state (EWRMP at 1.3 (1); EWSS at No. 3; FDREC Art 40 (3); EFWRMP Art 5) [18,19,35,104], and on the basis of the Ethiopian Water Resources Management Proclamation, 'water resource management means activities that include water resources development, utilization, conservation, protection and control (EFWRMP Art 2 (19)) [104].'

The inbuilt area of Addis Ababa is found in the Akaki river basin; and the absolute majority of industries in it dispose their effluent into the Akaki River, which joins to the trans-regional Awash River, which crosses the Oromia and Somalia National Regional States of Ethiopia (ESIA WWTPSLER KC at 17) [116].

Concurrently, the Ministry of Water, Irrigation and Electricity of Ethiopia is bound to internalize the cost of restoration of authorized degradation of the Akaki River and to incentivize sustainable effluent management through the practical implementation of a federal effluent charge (Gebregiorgs, M. T. (2016) at 38; EFWRMP Art 20 (1) (c) and 22) [11,104,113,141,142].

In practice, since the federal government has not yet developed the rate of its effluent charge [113,141,142], and there is no effluent charge collection system (Gebregiorgs, M. T. (2018) at 367–370) [127], the MWIEE is neither internalizing the social cost of authorized degradation of the Akaki River nor creating an incentive for the industries to sustainably manage their effluent [113,141,142].

As a corollary, at the moment, the absolute majority of the industries are barely using the full range of effluent abatement options, and they are directly disposing their untreated effluent into the Akaki River (ESIA WWTPSLER KC at 17) [21,22,25,113,116,141–151].

Thus, it is safe to conclude that, at the moment, the federal effluent charge of Ethiopia is not at all reinforcing the aspiration of Ethiopia to achieve sustainable water resource management by 2030.

## 9. Conclusions

The research assesses the viability of the design of the source, base, scope and rate of solid waste, landfill, sewerage service, and effluent charges in the achievement of sustainable waste management in the AAA of Ethiopia. In this research, the source of environmental tax is subject to the principle of legality as long as it is set up by legislative acts; the scope of an environmental tax in a federal system is appropriate when it is as broad as the scope of the waste being addressed, and is consistent with the fiscal needs of the federal and regional waste management organs. The base of an environmental tax is considered to be efficient when it is targeted to the waste or waste-generating behavior, which helps to incentivize the full range of waste abatement options and can contribute to specification of an optimal tax rate. The rate of environmental tax is considered optimal when it is commensurate with the cost of waste management and it creates an incentive for the realization of sustainable waste management. Correspondingly, this research has first indicated Ethiopia's commitment to a federal system, sustainable waste management, the polluter-pays principle and the distributive and incentive roles of environmental taxes. Secondly, it has shown that waste management is one the goals of sustainable development and it is applicable both in developed and least developed countries. Thirdly, it has displayed the mutual contribution of the achievement of waste management to the progress of sustainable sanitation and water resource management. Fourthly, it has shown the distributive and incentive roles of environmental taxes in the achievement of sustainable waste management. Fifthly, it has indicated that cautious design of the source, base, scope and rate of environmental taxes is a critical determinant for environmental taxes' overall success in addressing the prevalent waste mismanagement in Ethiopia.

This research, having the foregoing benchmark findings in its normative framework, has assessed the viability of the design of the source, base, scope and rate of solid waste, landfill, sewerage service and effluent charges in the practical achievement of sustainable waste management in the AAA. Consequently, it has demonstrated that:

(1) The sources of solid waste, landfill, sewerage service and federal effluent charges are set up by legislative acts, and in turn their sources are subject to the principle of legality, and there is no ground for environmental taxation without representation;

(2) The scope of solid waste, landfill, sewerage service and federal effluent charges is as broad as the scope of the waste being addressed, and it is consistent with the fiscal needs of the federal and the Addis Ababa Administration waste management organs, and in turn their scope is appropriate;

(3) Sludge and effluent are targeted as the bases of the sludge dislodging and federal effluent charges, respectively. Therefore, the sludge dislodging and federal effluent charges' bases efficiently target the wastes, which helps to incentivize the full range of sludge and effluent abatement options and can contribute to specification of their optimal rate;

(4) Water consumption, which is a close proxy of sewage, is targeted as the base of the sewer service charge. Thus, the base of the sewer service charge by and large efficiently targets the sewage-generating behavior, which helps to incentivize the full range of sewage abatement options and can contribute to specification of its optimal rate;

(5) Water consumption is taken as the base of solid waste and landfill charges. Therefore, the base of solid waste and landfill charges does not at all efficiently target the waste or waste-generating behavior and thus does not help to incentivize the full range of solid waste abatement options, nor does it contribute to specification of their optimal rate;

(6) The rates of solid waste, landfill and sewerage service charges make only a nominal contribution to the cost of solid waste and sewage management, and they barely create an incentive for the residents of the AAA to sustainably manage their solid waste and sewage, and as such their rates are slightly optimal; and

(7) Because Ethiopia has not yet developed the rate of the federal effluent charge, the federal effluent charge neither internalizes the cost of trans-regional water resource degradation nor incentivizes the polluters to sustainably manage their effluent.

As a corollary, the study has concluded that, having a somewhat viable design, solid waste, landfill and sewerage service charges are marginally reinforcing the aspiration of Ethiopia to achieve sustainable sanitation. Correspondingly, the results imply that the aspiration of Ethiopia to achieve sustainable sanitation and water resource management by 2030 is contingent on the cautious design of its waste management taxes.

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